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ON CERTAIN CHANGES IN THE BLOOD DURING SURGICAL ANÆSTHESIA.

By R. L. MACKAY, M.D., and S. C. DYKE, D.M.

From the Pathological Department, Wolverhampton and Staffordshire Hospital.

THAT there is a rise in the sugar percentage of the blood during surgical anæsthesia is well known. It is further well recognised that during anæsthesia certain regroupings of the buffering substances of the blood take place of such a nature as would lead, in the absence of compensation, to an increase in its hydrogen ion concentration. The present investigation represents an attempt to ascertain whether or not a relationship exists between the variations of the sugar content on the one hand and the regrouping of the buffering substances on the other.

Of the buffering substances, those of which the behaviour is best understood are the chlorides and the fixed carbon-dioxide of the plasma. These two substances therefore were selected as representative of the buffering system. It was long ago shown by Hamburger[1] that in blood treated with CO_2 Cl. ions pass from the plasma to the corpuscles and the amount of bicarbonate in the plasma increases. In this way blood is buffered against excess of CO_2. Van Slyke[2] has further shown that the opposite change occurs when the CO_2 tension of the plasma is lowered; the displacement of CO_2 radicles from bicarbonate of the plasma by the stronger Cl ions leads to lowering of the fixed CO_2 of the plasma, or, as usually expressed, to a diminution in the alkali reserve. Although

these changes are seldom associated with any actual lowering of the pH of the blood their occurrence may be regarded as an indication of the existence of factors tending to produce such a lowering.

For the estimation of the chlorides of the plasma and of whole blood a relatively simple method exists in that described by Austin and Van Slyke.[3] The fixed carbon-dioxide of the plasma was estimated by the method of Cullen and Van Slyke.[4] Blood sugar estimations were carried out by the method of MacLean.[5]

The material for the investigation was provided by 39 patients of varying age and of both sexes, all of whom were anæsthetised for surgical purposes. The patients were taken as they came to the operating theatre, the only selection practised being the award of preference to those patients the nature of whose case rendered it probable that the anæsthesia would last for over an hour; for this reason most of the cases represent relatively serious and difficult operative procedures.

The anæsthetic employed varied according to the needs of the patient and the taste of the anæsthetist. Induction was generally by chloroform alone or by CE Mixture, while anæsthesia was maintained by CE Mixture or by ether; no case of pure chloroform anæsthesia was included in the series. So far therefore as pure chloroform anæsthesia is concerned it is impossible to draw any conclusions; as between ether and CE Mixture the results appear to show no significant difference.

Blood was withdrawn from an arm vein without stasis into centrifuge tubes containing a little potassium oxalate. The one sample of blood was used for all determinations. Samples were taken before the induction of anæsthesia, and at approximately half-hourly intervals therefrom, as shown in the charts.

Advantage was taken of the fact that one of the surgeons (E. D.) whose cases supplied the material made a practice of using local and regional anæsthesia in conjunction with the general anæsthetic, to investigate the possibility of the existence of demonstrable differences between the changes in the blood in the presence and in the absence of such local anæsthesia. For the induction of local anæsthesia 30 ccm. of 1 per cent. solution of Novocaine in saline were introduced into the

abdominal parietes; this was followed after the abdomen had been opened by the injection of a further 70 ccm. of the same solution into the retroperitoneal tissue in the neighbourhood of the cœliac ganglia. For the purposes of comparison, the results obtained from the cases receiving local and regional anæsthesia in addition to the general anæsthetic are grouped at the head of the following tables.

SUMMARY OF TABLE A.

(*a*) Of 38 cases the directions of the chloride changes in the plasma during anæsthesia (0.10 mgms. being accepted as the experimental error of the method) are as follows:

Increase in plasma	23 cases
No change in plasma	11 ,,
Decrease in plasma	4 ,,
	38 ,,

(*b*) *The Rate of Change.* Of all 22 cases where 3 estimations were made, the average is as follows:

Period of Anæsthesia.	Plasma Chloride (Mgms. Na Cl. per 100 cc.)
0 minutes	586
30 ,,	593
60 ,,	593

(*c*) *Rate of Change in Ether, and in CE Mixture Anæsthesias.*

	Time.	Plasma Cl.	
Anæsthesia mainly CE Mixture (13 cases)	0 mins.	591	
	30 ,,	598	
			Difference=7
Anæsthesia mainly pure Ether (18 cases)	0 mins.	585	
	30 ,,	589	
			Difference=4

(*d*) *Course of Plasma Chloride without and with Regional Anæsthesia.*

	Time.	Plasma Cl.
Average of 10 cases with no regional anæsthesia	0 mins	602
	30 ,,	613
	60 ,,	607
Average of 12 cases with regional anæsthesia (omitting No. 6)	9 ,,	573
	30 ,,	577
	60 ,,	582

(*e*) *Whole Blood Chloride.* Of 24 cases examined during anæsthesia, 20 showed no change, and 4 showed an increase very slightly

greater than the error of the method. Average=4.82 mgms. NaCl per 100 cc. whole blood.

SUMMARY OF TABLE B.

Of 22 cases examined, the Alkaline Reserve decreased in 20. The average of 8 long anæsthesias is as follows :

Time.	Alkaline Res.
0 minutes	68.4
30 ,,	63.8
60 ,,	62.7
90 ,,	61.6

SUMMARY OF TABLE C.

Of 36 cases examined, the blood sugar was found to increase in every one.

The average of 16 cases of 3 readings is as follows :

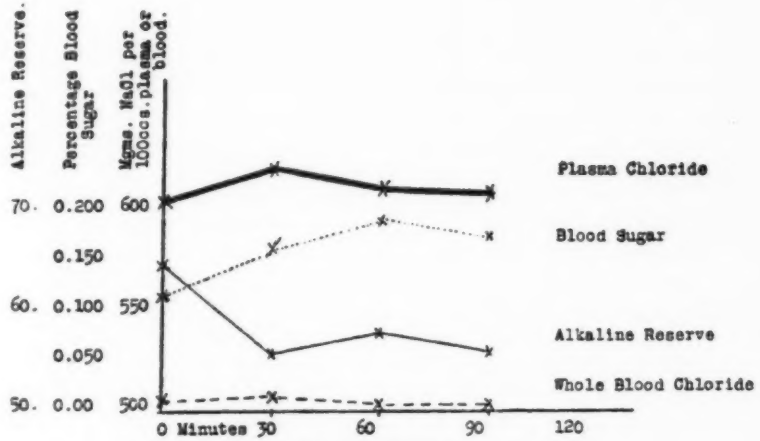
Time.	% B.S.
0 minutes	0.94
30 ,,	0.135
60 ,,	0.155

The average of 5 long cases is as follows :

Time.	% B.S.
0 minutes	0.083
30 ,,	0.136
60 ,,	0.143
90 ,,	0.147

The above tables show a behaviour so general as to be almost constant in the three constituents of the blood examined during anæsthesia. The plasma chlorides show a rise, more marked at first, but often tending to cease or even to be replaced by a slight fall after anæsthesia had been established for an hour or more. The chlorides of whole blood remain constant, showing that the rise in the plasma chlorides is due to a shift of Cl ions from the red cells, and is in fact an example of the "Hamburger Effect;" the fixed CO_2 of the plasma shows a fall, early and rapid at first but tending to become slower and to cease altogether as anæsthesia proceeds; the sugar of the blood in all cases shows a rise early and rapid at first but tending to be replaced by a slow movement towards the original level about the end of the period of anæsthesia.

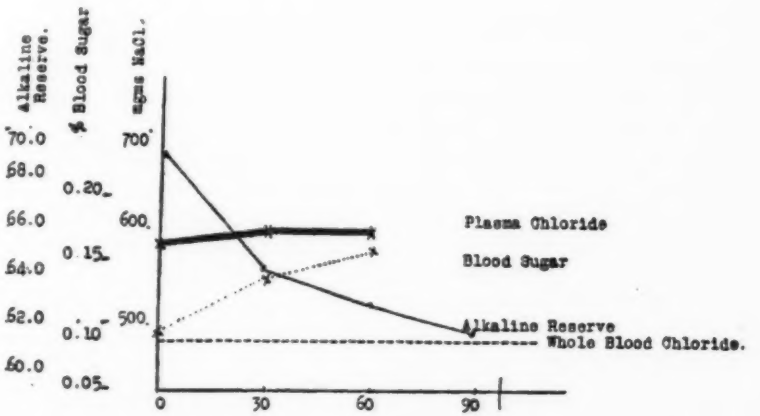
The following graph plotted from case 21 shows the behaviour of the various factors examined in a typical case.



BLOOD CHANGES DURING ANAESTHESIA CASE 21.

J.A. aet 46 yrs. Gallstones and Chronic Appendicitis

Open CE Mixture for 105 minutes No regional anaesthesia.



Graphs to show actual averages obtained

Examination of the above tables reveals two facts of interest.

In the first place, there appears to be little difference between the variations shown by the various chemical factors examined in cases receiving local and general anæsthesia and those operated upon under general anæsthesia only. On plotting the average course of the plasma chlorides in the two classes of cases, there is found to be a tendency for the chlorides in the cases receiving no local anæsthetic to revert towards their original level, while in the cases receiving a local anæsthetic this tendency is absent. The difference between the two sets of readings is, however, so slight that its significance is doubtful. It should be remembered too that the effects of the local anæsthetic would in any case be less marked on the second than on the third estimation. The fixed CO_2 of the plasma and the sugar of the blood behave in practically the same way in both classes of cases.

The second point of interest is that although in all cases a rise of the blood sugar is present, the extent and duration of the rise differs considerably from case to case; this difference, moreover, appears to bear no relationship to the behaviour of the chlorides and of the fixed CO_2 of the plasma which is of a remarkably constant type.

The cause of the variation of the elements investigated is obscure. Whatever be the causal factors concerned it is difficult to avoid the conclusion that those influencing the chloride shift from red cells to plasma and the fixed CO_2 of the plasma are not the same as those bringing about the rise of the blood sugar. Were they the same it is reasonable to presume that the extent and duration of the variation of the different elements would be comparable from case to case. That this is not so is well shown by case No. 1, in which a very considerable and very sudden rise in the blood sugar is associated with minimal changes in the chlorides and fixed CO_2 of the plasma.

Summary.

The behaviour of the chlorides of the whole blood and of the plasma, of the fixed CO_2 of the plasma, and of the blood sugar has been observed in a series of 39 patients under the

influence of general anæsthesia for surgical purposes. Of these cases 13 received local and regional in addition to general anæsthesia. The remainder received a general anæsthetic only.

Conclusions.

1. During anæsthesia the chloride content of the plasma shows a rise; that of the whole blood remains constant. There is a "shift" of Cl ions from the red cells to the plasma.

2. During anæsthesia the fixed CO_2 of the plasma shows a fall, rapid at first but tending to become slower and to cease altogether as anæsthesia proceeds.

3. During anæsthesia the blood sugar rises, at first rapidly. Later the rise becomes slower, and still later this may be replaced by a slow movement towards the original level.

4. There is no apparent relationship between the extent and duration of the variation of the chlorides and the fixed CO_2 of the plasma on the one hand, and of the sugar content of the blood on the other.

5. As between cases operated upon under local and regional in addition to general anæsthesia alone, the investigation revealed no significant differences in the behaviour of the phenomena under observation.

References.

1. Hamburger, *Biochem. Zeitschr.*, 1918, 86, 309.
2. Van Slyke, *Physiol. Reviews*, 1921, 1, 161.
3. Austin and Van Slyke, *Journ. Biol. Chem.*, 1920, 41, 345.
4. Cullen and Van Slyke, *Journ. Biol. Chem.*, 1917, 30, 289.
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CONTROLLABLE SPINAL ANÆSTHESIA WITH SPINOCAIN.

By GEORGE P. PITKIN, M.D., F.A.C.S.

Surgeon in Chief to the Holy Name Hospital, Teaneck, N.J.

THE *New Jersey State Medical Journal* in July 1927, first published my report of Controllable Spinal Anæsthesia, in which starch paste was employed to produce a viscid solution that would not diffuse with the spinal fluid.

In this article it was shown how the solution differed in its physiological action from various other methods. It explained when, and how, the anæsthetic was absorbed; the similarity of intradural to intravenous pressure; how, and when elimination from the dural sac took place, as well as the physiological action of various drugs ordinarily used, as stimulants, to maintain the blood pressure; also why severe reaction was noticed with certain anæsthetic agents used for spinal anæsthesia, and how others could be rendered practically harmless.

Since the preliminary report of 600 cases, Controllable Spinal Anæsthesia of Spinocain (Metz) as it is now known to the trade, has been distributed to the profession for clinical tests, and an excess of 6,500 inductions prove conclusively the claims made for it.

There is an old saying "Two heads are better than One," and this is thoroughly realized and appreciated, as the careful observations and many suggestions offered by Doctors Hooper, Kelly, Sise, Campbell, Willinsky, Earlich, Wetheral, Peabody, Prichard, Pease, Denman, Baker and McCormack have materially assisted in perfecting spinocain. Dr. Hooper spent eight months in perfecting a method to prevent fermentation and precipitation, and in rendering the solution stable and uniform. He discovered that gliadin (the mucilaginous content of wheat starch) produced the viscosity, a constituent

of the starch paste, and devised a method of extracting the gliadin and rendering it soluble.

Dr. Sise found that amounts of spinocain equivalent to 300 or 400 mg. of novocain produced less by-effects and caused less toxic symptoms than when 65 mg. of novocain or beocaine crystals were dissolved in spinal fluid and injected into the subarachnoid space.

Doctors Kelly and Willinsky had much to do with establishing the amount of ephedrine required to stabilize the blood pressure. They invariably carry their patients through an operation with an increased pressure of 20-40 points eliminating all shock.

Dr. Peabody in his orthopedic work has so perfected his technique, that he is able to limit anæsthesia below the brim of the pelvis, invariably without motor paralysis.

Dr. McCormack offered valuable suggestions in regard to post-anæsthetic phases and in his study of 3,000 cases of spinal anæsthesia where various methods and drugs had been employed finds less shock, acidosis, dehydration, suppression, retention, headaches and sphincter paralysis with the use of spinocain.

By substituting sodium iodide for the novocain without altering the viscosity of the solution we performed lumbar punctures on cadavers, using the same technique and with as much care as on the living. The X-Ray showed us the position of the solution with the subject in various degrees of Trendelenburg and after various amounts of mixing with the spinal fluid. In this way we know how much expansion of spinocain is required to produce anæsthesia to a definite height on the body surface as well as the degree of Trendelenburg necessary to maintain the anæsthetic at the desired level. The degree of Trendelenburg is hard to guess but easily measured with the tiltometer.

Spinocain will not diffuse in spinal fluid, but it will mix with it. By withdrawing or aspirating 1 or 1½ c.c. of spinal fluid into the syringe containing the spinocain, then injecting one-half of the contents of the syringe; again aspirating 1 or 2 c.c. of spinal fluid, the volume may be increased by repeating this procedure sufficiently to carry anæsthesia to any desired height. The patient should remain in a 5 degree Trendelen-

burg five to ten minutes to permit the anæsthetic to become fixed. If an extreme Trendelenburg is immediately assumed the solution will tend to resume its original volume in the lower lumbar canal. Never attempt to expand the solution to more than 8 c.c. 12 c.c. will in an ordinary person of 150 pounds carry anæsthesia to the cervical region.

The technique of controlling the anæsthetic and limiting its contact to only those spinal nerves that are necessary to produce anæsthesia to a definite height on the body surface, is relatively simple with spinocain. With a working knowledge of the capacity of the dural sac, the size and age of the patient should be considered, and the degree of Trendelenburg accurately measured to obtain the best results.

A correct amount of gliadin in the solution will prevent diffusion until the anæsthetic has been absorbed by the nerve trunks. Too much gliadin greatly delays or entirely prevents anæsthesia. Too little gliadin causes the solution to be devoid of all controllable features. The viscosity of the solution causes it to remain in mass and the alcohol is sufficient to produce a specific gravity much less than the spinal fluid which makes it float in the canal as an air bubble does on a spirit level. By altering the degree of Trendelenburg the position can be regulated as desired.

If anæsthesia is not high enough raise the head of the table until anæsthesia is obtained at the required height and then return to a slight Trendelenburg. Never leave the head of the table elevated. It is needless to say that this must be done in the first 5-10 minutes after injection before the anæsthetic has become fixed.

When spinal fluid or normal saline is used as a vehicle, there is no controlling the anæsthetic after it is once injected. They both diffuse very rapidly in the spinal fluid and tend to gravitate to the dependent parts of the canal.

The observations made in our own hospital and the reports by various members of the profession working independently and unknown to each other, in a study of over 6,500 cases, prove conclusively that spinocain has many advantages over other forms of spinal anæsthesia.

In that it is controllable within the dural sac, contact may be limited to those strands of the cauda equina that make up

the sacral nerves producing intradural sacral anæsthesia, or it may be extended to the crest of the ileum, the umbilicus, or be limited to the costal margin.

The blood pressure is not materially affected. Because high anæsthesia is prevented, only half of the vasomotor constrictors are affected. Strychnin inhibits the action of novocain on the anæsthetized vaso-constrictors, while ephedrine stimulates the unanæsthetized branches and counterbalances the action of the anæsthetic. 50 mg. of ephedrine will stabilize the blood pressure: 100 mg. will raise it 20-40 points above normal.

Pallor and cold sweats do not occur. The colour does not change, if anything the face is flushed throughout the operation.

Dry wounds are not observed. There is as much bleeding as with inhalation anæsthesia. The danger of secondary hæmorrhage is avoided.

Nausea and vomiting during operation occurs very rarely. This is accounted for by preventing high anæsthesia and diffusion to the bulb.

Toxicity is reduced. Amounts equivalent to 200 or 400 mg. of novocain will produce no more by-effects than 65 mg. of neocain does when dissolved in spinal fluid and injected into the subarachnoid space.

The duration of anæsthesia is dependable and in direct ratio to the amount of solution injected. It does not become diluted by diffusion.

Satisfactory anæsthesia occurs in practically all cases with a proper technique. If anæsthesia does not occur it is due to the technique and not the solution.

Expansion of volume may be accomplished by mixing it with spinal fluid. It will not diffuse until the anæsthetic has been absorbed.

Stimulation does not have to be resorted to during the operation. The radial or temporal pulse volume remains constant.

Shock is entirely eliminated: It is amazing to see the way these patients go through an operation. There is no post-operative reaction.

Suppression does not occur. The physiology of the kidney is not altered. Filtration is not lessoned. Secretion is unimpaired, as there is no hypotension.

Retention occurs less frequently, and there is no incontinence due to the anæsthetic.

Headaches are rare and when they occur are of a shorter duration and less severe.

Palsy has not been reported in 6,500 inductions.

Paralysis of the sphincters is unknown.

It will not cause reverse peristalsis, or vomiting in mechanical ileus. It will relieve paralytic ileus. With distention, or paralytic ileus a high anæsthesia will produce gurgling in five minutes, gas is passed in eight to ten minutes, and a copious evacuation within fifteen to twenty minutes. The abdomen becomes soft and distention disappears; an effectual therapeutic remedy. It is valuable as a diagnostic agent in differentiating between mechanical and paralytic ileus.

In kidney or ureter work it is superior to other forms of spinal, due to its light specific gravity. It rises to the crest of the spinal canal when the body elevator is adjusted and anæsthesia is produced at the desired point.

Shock blocks, post-operative, do not have to be used. Fowler's position may be assumed in two hours.

Time is saved as the sterile solution, in ampules, is ready for use at all times.

Hypotension is not a contra-indication for its use. The blood pressure may be made to assume normal by using 2 or 3 of the ephedrine-novocain ampules as indicated.

The safety features of spinocain have caused many operators to return to this form of anæsthesia, who had abandoned spinal.

Cardiac or respiratory embarrassment does not occur, as when spinal fluid is used as a vehicle for novocain or neocain.

Morbidity of surgery is reduced. Post-operative vomiting, dehydration and acidosis do not occur. When the patients are returned to bed they are happy and cheerful.

Convalescence is shortened.

The technique for using spinocain differs from that of many other forms of Spinal Anæsthesia. To obtain satisfactory results the procedure as described should be followed. Spino-

cain is much lighter than spinal fluid and will ascend rapidly in the spinal canal if the head of the patient is raised. *It should never be given with the patient in the sitting position.*

The success one enjoys with Spinal Anæsthesia will be in direct ratio to the degree of perfection attained in the technique of administration.

Failures are not due to the solution but carelessness, or mistakes at the time of induction.

When using spinal conduction or local anæsthesia the paramount thought and endeavour should be at all times, never to hurt the patient in any way, at any time. A patient once subjected to pain may not only lose confidence in the method, but the ability of the surgeon. A lost confidence is frequently the direct cause of unsuccessful anæsthesia.

To be successful with spinal anæsthesia the technique should be developed to such finesse that pain is never experienced by the patient, so that he may be carried through the operation in a happy and cheerful frame of mind.

Apparatus.

The syringe employed in Spinal Anæsthesia should preferably be of an all glass type with a suitable locking device that will permit of the manipulation of the needle and syringe without fear of detaching, so contructed that there is no danger of leaking, or the possibility of injecting air; a locking device that will not "jam" or permit the needles to "blow off." The Luer Lok is recommended, a 2 c.c. for local infiltration and a 3 c.c. for spinal injection.

The needles should be made of rustless steel because they are less apt to break unexpectedly. They retain a sharp point longer and will withstand a good deal of bending and manipulation. They are easily cared for by the nurses. The lumen does not corrode or clog.

The needle for raising the cutaneous wheal should be fine, 25-27 gauge; sharp and provided with a safety guard to prevent disappearance in case it should break in the tissues.

The spinal puncture needle should have as small a calibre as practicable, 20-22 gauge. The smaller the needle the less trauma and injury to the tissues; less post-operative backache. The bevel at the point chould be 45 degrees, never a

long bevel of 20 or 30 degrees. The author's needle has a blunt taper, the rear of which is rounded off so that it cuts a miniature trap door in the dura which closes by intradural pressure when the needle is withdrawn preventing seepage of spinal fluid and œdema of the tissues. It is inadvisable to use the large Bier needle of 15-17 gauge or a needle with a long tapered point. With these needles not only is trauma of the tissues produced, but unnecessary bleeding frequently occurs. Satisfactory anæsthesia is not always secured due to a part of the taper being within the dura, the remainder outside; in this case, part of the solution is deposited extra-durally. Again if a part of the taper is within a vein and the solution is injected convulsions may result.

The spinal puncture needle should be made of rustless steel (not nickeloid or nickelplated). To avoid accidentally breaking the needle in the tissues it should always be tested by bending it into a semi-circle with the stylet removed before sterilization.

The ampules should be stored in a glass container filled with 70 per cent. alcohol. The neck of the ampule may be broken with a file or better still nipped off with a sterile artery clamp. The contents of the small novocain-ephedrine ampule is drawn into the 2 c.c. syringe; the 3 c.c. syringe to receive the contents of the 2 c.c. spinocain ampule. It is advisable to use two syringes rather than refill a syringe with two different solutions.

The equipment for spinal anæsthesia is simple and inexpensive:

1 3 c.c. Luer Lok Syringe.
1 2 c.c. Luer Lok Syringe.
1 Pitkin Spinal Puncture Needle.
1 Hypodermic Needle.
1 Ampule Spinocain.
1 Ampule Novocain-ephedrine solution.
1 Pair Gloves.
1 Artery Clamp.
1 Sponge Holder.
Sponges.
Iodine 5 per cent. solution.

The technic of administering spinocain should be adhered to without deviation, if the best results are to be expected.

The spinal puncture and injection of spinocain should be performed with the patient lying on the side, with the knees flexed upon the abdomen, head bent forward and the back bowed out. This position separates the spinous processes of the vertebræ. The spinal puncture may be made with ease in this position. The shoulders and hips should be in a vertical line. If the shoulders are tilted and the hips vertical, or the hips tilted and the shoulders remain vertical, either of these positions produce a corkscrew spine, which presents difficulties at the time of puncture. A scaphoid back should be avoided as this makes the puncture painful and difficult, due to the over-riding of the spinous processes.

The head of the table should be lowered so as to place the patient in a 5 degree Trendelenburg position, measured with the tiltometer, (author's).

If a right sided operation is to be performed have the patient lie on the left side; as the solution is of a light specific gravity it rises in the canal and anæsthetizes the nerves of the right side first. For a left sided operation it is advisable to lay the patient on the right side; with median incisions there is no choice.

In fractures of the legs it is possible to anæsthetize only the injured leg by observing the above.

With the patient in position the skin from the fifth or sixth dorsal vertebra to the sacrum is painted with a 3-5 per cent. tincture of iodine over a wide margin, then by palpating along the spine from the twelfth dorsal to the fifth lumbar a wider interspace will be found which is selected as the point of puncture. This is marked by firm pressure with the thumb nail of the gloved hand, which will leave a mark on the skin easy to find.

The interspace selected for the site of puncture does not matter materially as the extent of anæsthesia is regulated almost entirely by the degree of Trendelenburg employed and the amount of expansion obtained by mixing the solution with the spinal fluid. For stomach and gall bladder work a quicker anæsthesia will be obtained if the first lumbar interspace is selected. At the site selected for the spinal puncture a cutaneous wheal is raised with .65 c.c. of:

Novocain	.013
Ephedrine	.5
Normal Saline qs.	1.3

using a fine hyperdermic needle as described above. Without withdrawing the needle it is carried directly into the interspinous ligament injecting the other .65 c.c. of solution as the needle advances, always endeavouring to inject the solution a little faster than the needle proceeds. In other words the needle is introduced into the freshly anæsthetized field, thus anæsthetizing the tissues to the dura.

The spinal puncture is made through the centre of the wheal raised with a novocain-ephedrine solution with a fine 22 gauge lumbar puncture needle. In making the puncture through the interspinous ligament care should be taken not to deviate to the right or left. The puncture should be at right angles to the long axis of the spine. Never attempt the puncture between the laminae. Avoid inserting the needle in an upward direction or at an acute angle to the spine. The veins about the cord are large and numerous, but may be avoided and not penetrated if the spinal puncture is made in the above manner. Unnecessary bleeding will surely be produced should the puncture be attempted between the laminae; with the needle at a tilt: with a needle of large calibre, or with a long tapered point. When the dura is punctured there is a slight snap which is recognized after the first few punctures, and the needle advances with less resistance. Avoid, if possible the point of the needle piercing the opposite side of the dura, or coming in contact with the body of the vertebra, as this may cause bleeding. With the assurance that the dura has been entered the stylet is removed and spinal fluid should flow through the needle. If there is no spinal fluid rotate the needle on its own axis. If there is still no spinal fluid insert it deeper. If bony resistance is felt (the body of the vertebra) the needle has undoubtedly deviated to one side. It should be withdrawn to the skin surface and reinserted at a slightly different angle, to the right or left as the case may be. Always have the stylet in place when making manipulations. Occasionally the first drop or two of spinal fluid will contain blood. If this clears the injection may be made. If not, the needle should be

withdrawn and reintroduced. The injection of the anæsthetic solution should never be made until clear spinal fluid flows through the needle, which is the only assurance that the point of the needle in within the dural sac. Unless the solution is injected into the subarachnoid space, anæsthesia will not be satisfactory.

It is advisable to fill both syringes with their respective solutions before the spinal puncture is started, and place together with the needles in a convenient position to the operator. Attach the syringe containing the spinocain to the spinal puncture needle in place. If anæsthesia is desired in the perineal region aspirate one or two drops of spinal fluid to reassure yourself that the needle is in place and inject 1 c.c. of the solution, immediately placing the patient in a 15 to 18 degree Trendelenburg, as measured by the tiltometer. If anæsthesia is desired in the legs aspirate 1 to 2 c.c. of spinal fluid into the syringe; to expand the solution inject the contents and place the patient in a 10 to 15 degree Trendelenburg. Should you desire to carry the anæsthesia to the umbilicus aspirate and reinject 2 to 4 c.c. of spinal fluid making a total volume of 4 to 6 c.c. of the expanded solution. Place the patient in a 7 to 10 degree Trendelenburg if anæsthesia is desired to the costal margin, aspirate and reinject with the solution 6 c.c. of spinal fluid. This added to the contents of the ampule will expand the spinocain to a total volume of 8 c.c., which will fill the subarachnoid space to the sixth or seventh dorsal vertebra. The patient is to remain at a 5 degree Trendelenburg. If for any reason aspiration and mixing cannot be accomplished satisfactorily the head of the table may be raised temporarily to allow the spinocain to ascend in the canal. As soon as anæsthesia is obtained at the desired height the patient should again be placed in the position above described.

As soon as the injection is made, withdraw the spinal puncture needle and cover the punctured wound with colloidin and cotton or with a small square of adhesive plaster. Turn the patient on the back and immediately adjust the table to the desired degree of Trendelenburg indicated. A sharp line of demarcation of anæsthesia can be accomplished by familiarizing yourself with the technique; by judging the amount of mixture of the spinocain and spinal fluid required for various

sized individuals; and by accurately determining the degree of Trendelenburg to be employed.

The amount of ephedrine in the small ampule is sufficient to counterbalance any action that novocain may have on the vasomotor constrictors, provided the anæsthesia is not permitted to extend higher than the costal margin. In patients suffering with hypotension or shock, two ampules of the novocain-ephedrine solution will cause the blood pressure to return to normal. In severe cases of shock, or hæmorrhage 3 c.c. of the novocain-ephedrine solution may be employed without harm.

The viscosity of spinocain inhibits slightly the absorption of the novocain by the nerve trunks and slightly delays anæsthesia. Satisfactory anæsthesia cannot be expected within five to seven minutes after the injection of the solution into the subarachnoid space. This retarded absorption reduces the toxicity of the novocain and prevents the symptoms that ordinarily occur in spinal anæsthesia. It also stabilizes the duration of anæsthesia, as well as permits of larger doses.

It must be remembered that anæsthesia first presents itself in the perineal region, the legs, the lower abdomen and gradually ascends on the body surface. When it subsides it disappears in a reverse manner; that is, anæsthesia may be maintained in the perineal region for two to two and a half hours without difficulty. In the upper abdomen it will not be satisfactory for more than one hour to one hour and a half. It may be maintained for a longer time with spinocain by employing 3 c.c. or 4 c.c. of the solution.

One hour before the operation the patient is given morphine sulphate .016 gm., scopolamin .0004 gm. This in no way intensifies the anæsthesia; it allays fear and lessons the apprehension of the patient. In extremely nervous individuals it is permissible to increase the morphine to .02 gm. Satisfactory results with spinal anæsthesia will not always be obtained and unpleasant complications may arise unless the patient is watched throughout the procedure by some one qualified and trained to observe the symptoms as they may arise. This may be done by a professional anæsthetist or a trained psycho-anæsthetist. The ordinary operating room nurse is of little or no value at the head of the table when

spinal anæsthesia is being employed. A good psycho-anæsthetist will lift a great deal of responsibility from the surgeon's shoulders and relieve him of all care and worry during the operation. He knows how to care for the patients' wants, how to make them comfortable and has the ability and knack of allaying fear and apprehension, and often times is able to absorb the patient's attention so that the operation may be performed without his knowledge. The psycho-anæsthetist knows how to prevent vomiting if nausea occurs; how to regulate the degree of Trendelenburg to maintain anæsthesia at a desired level. He takes and records the blood pressure readings and is capable of distinguishing the difference between psychic shock and true shock. If stimulation is required he knows how much and what to administer. Physicians who have witnessed my work attribute 50 per cent. of my success to my psycho-anæsthetist. This, of course, I cannot admit. She knows nothing of inhalation anæsthesia and I am glad to say has no occasion to acquire that knowledge. She has that rare personality that inspires confidence, an education that enables her to talk on any subject. She either jollies her female patients or engages them in such interesting conversation that we are often able to complete an operation while the patient believes she is still being prepared. She has just enough "it" to make the male patient forget all about the operation, and with her lolly pops and fondling she performs wonders with youngsters.

With the introduction of spinocain we believe that spinal anæsthesia will be revolutionized. With Controllable Spinal Anæsthesia the dreaded complications of Spinal Anæsthesia, as you have witnessed them in the past, do not occur. The tremendous drop in blood pressure is never witnessed and with the proper technique, stimulation is never required. Pallor is not observed. Not infrequently does the patient's colour become more rugged than before the anæsthesia was administered. Nausea and vomiting during the operation rarely if ever occur. Post-operative headaches are greatly diminished and when they do occur are very mild. Speaking of headache, I believe the old idea that seepage, or withdrawal of too much spinal fluid as a cause is erroneous to a certain extent. Following spinal anæsthesia we have two varieties of headaches to

consider, one that occurs only when the patient sits up or raises her head, which is relieved by assuming a reclining position. This is due to an abnormally low cerebral spinal pressure due to seepage, the withdrawal of too much fluid, or high anæsthesia and extreme hypotension. The constant, persistent throbbing headache is due to increased cerebral pressure and initiation. The cell count of the spinal fluid is increased as well as the pressure. This headache is more apt to follow the use of stovain or apothesine, or where several "jabs" have been made in the dura in attempting the puncture. A secondary tap and withdrawal of enough spinal fluid to reduce the tension will relieve this form of headache.

The indications for spinal or local anæsthesia are invariably acknowledged in cases of tuberculosis, bronchitis, emphysema, asthma, heart complications, pyelitis, diabetes, nephritis, acidosis, hypertension and in alcoholics or addicts. It is a conceded fact and well acknowledged by those familiar with this spinal anæsthesia, that the mortality of acute abdomens is greatly reduced, and for general or local peritonitis it is almost a specific, if such is possible. It relieves rigidity, reduces distension, collapses the intestines, stimulates peristalsis and relaxes the sphincters. Cases that have been bound up and distended for days will be relieved at once with a copious evacuation on the operating table.

The profession at large is beginning to realize that spinal anæsthesia should not be held in reserve for the old morbid case and used, as a last resort, where they dare not administer any form of inhalation anæsthesia. They should realize that it is an anæsthetic for the young and robust. If the surgeon would look upon it as such, and reserve local or splanchnic for the case with one foot on a banana skin and the other in the grave, he would be doing a great deal for humanity and spinal anæsthesia in general.

The increase in spinal, conduction and local anæsthesia for the past twenty years has been tremendous. In 1908, Dr. Hertzog introduced novocain into America. That year two pounds were sold. In 1927 two hundred pounds were used daily by the medical profession.

In conclusion, I do not desire to imply that you should employ spinal or local anæsthesia, but to-day when spinal

anæsthesia has been developed to the point of safety which it now enjoys, if you do use it, you will have one of the safest anæsthetics, and an anæsthetic that will not give you troublesome after-effects, as nausea, vomiting, gas distension, acidosis, pneumonia and innumerable other after-effects of inhalation anæsthesia. Another thing which must be borne in mind by all of us is the patient. We must remember that the patient to-day is becoming enlightened and educated in anæsthetics, as well as other surgical procedures, and we are more or less public servants, here to serve the public to the best of our ability and to their liking. The surgeon 10 years from to-day, perhaps much sooner, who is not a master of the technique of spinal, local and conduction anæsthesia, is not going to enjoy that good clientele that his competitor has across the street, who administers all of these forms of anæsthesia. There is no operation upon the human body that cannot be performed with greater facility with spinal or conduction anæsthesia than with inhalation anæsthesia, and the post-operative complications and dangers of the latter must always be borne in mind.

The European surgeon has for many years recognized the superiority of local conduction and spinal anæsthesia. On the Continent they are used quite generally.

Spinal anæsthesia is adaptable to all types of cases. Be the blood pressure high or low; the patient old or young; fat or thin; cardiac, nephritic, alcoholic or addict; but, in cases of extreme shock from hæmorrhage, or toxic and morbid patients, a local anæsthetic should be employed in preference to any other form of anæsthesia.

It is the safest form of anæsthesia we possess for operative procedures below the costal margin.

Spinocain is controllable within the spinal canal. Upward extensions or dissemination need not be feared.

Ephedrine and adrenalin are the only drugs to be relied upon in an emergency. Do not waste valuable time experimenting with other stimulants.

Watch spinal, conduction and local anæsthesia increase in popularity in the next 10 years.

NOTES ON DIFFICULTIES TO THE INDUCTION OF NITROUS OXIDE AND OXYGEN ANÆSTHESIA IN INFANTS.

By J. Ross Mackenzie, M.D.,

Lecturer on Anæsthetics, University of Aberdeen; Anæsthetist, Royal Aberdeen Hospital for Sick Children; Assistant Anæsthetist, Aberdeen Royal Infirmary.

THE induction of surgical anæsthesia in infants and young children with gas and oxygen is a much more difficult procedure than is found in the adult and the time required for induction, even when successful, is a serious obstacle to its routine use with the ordinary gas bag and valvular apparatus.

Flagg[1] states that the age at which nitrous oxide and oxygen may first be used is five to eight or ten years and he is supported, to some degree, in this contention by Robinson,[2] Gwathmey[3] and Blomfield.[4]

The factors which operate against this type of anæsthesia in the infant, are chiefly anatomical, physiological, chemical and mechanical.

The round shape of the infant chest permits easy expansion of the lungs, for the most part, only in a vertical direction. Expansion is further limited at the bases by deficient movement of the diaphragm owing to the large liver found in the infant.

This explains why the normal respiratory exchange in the infant is relatively much smaller than in the adult.

In actual administration, the tidal wave of the infant is frequently so minute that no movement is seen in the covered chest and abdomen, no sound of respiration is heard and the only indication of respiratory function may be a slight ripple upon the gas bag.

Under these circumstances, it is obvious, that diffusion of anæsthetic gases through the reserve air to the alveoli

must be an extremely slow process, and in my experience many infants have been in the first stage of induction after five minutes' administration.

The trachea and bronchi are relatively large in the infant and provide it with an enormous respiratory vital capacity. It is this vital capacity which enables the infant to stop breathing for thirty to sixty seconds, and to repeat this action during the induction without any evidence of anoxæmia, inconvenience or discomfort.

Voluntary apnoea in infants is especially liable to occur in administration with a closed apparatus.

It is characteristic of general anæsthesia in infants that they pass very slowly through the early stages of induction and then pass rapidly into surgical anæsthesia. The explanation of the early phase is the small respiratory exchange and large vital capacity while the late phase is due to instability and lack of control on the part of the central nervous system.

In gas and oxygen anæsthesia, infants and children require more oxygen than adults. Infants are extremely susceptible to oxygen starvation and frequently require 30—40 per cent. of oxygen to keep them pink. This applies particularly to the induction but operates also during the maintenance of anæsthesia. The importance of this fact is that under atmospheric pressure conditions, the percentage and partial pressure of nitrous oxide is proportionately lower and the anæsthetic action proportionately less.

Probably the greatest obstacle to progressive induction of gas and oxygen anæsthesia in the infant is the closed bag and valves in ordinary use. These present an insuperable difficulty to easy respiration and tend to reduce the normal respiratory exchange to a minimum or produce temporary cessation of respiration on account of the following elements inherent in the apparatus.

1. Positive pressure of gases in the bag is of value only during the late stage of induction. In the early stage of induction positive pressure is a definite hindrance since expiration is rendered more difficult against the flowing tide of gases from the bag. Further the diffusion of oxygen under pressure and the large vital capacity of the infant reduce the necessity for respiration to a minimum.

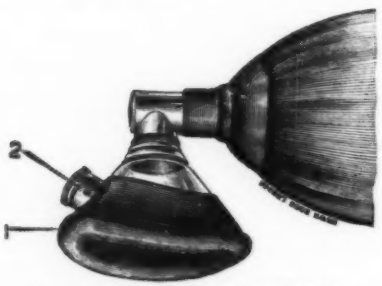
2. Theoretically, even in infants, some degree of re-breathing may appear necessary and useful since in this way carbon dioxide is accumulated and stimulates a respiratory exchange which will produce and maintain surgical anæsthesia but in actual practice the task of rebreathing during the early part of induction in place of stimulating rather depresses or inmibits the respiratory function.

3. The expiratory valve in the Barth's three way tap is so distant, that even when open the force of the infant's expiration will rarely be sufficient to lift the rubber flap. Thus, it is found that the exhaled air and gases go by diffusion into the bag or are re-inhaled by the inspiratory act before they reach the bag.

The same difficulties present themselves, to a lesser degree, in children up to five years of age.

It appears obvious, therefore, that for gas and oxygen anæsthesia in infants and young children, without undue delay in the early part of the induction, means must be found for rapidly replacing the reserve and residual air by nitrous oxide, and oxygen. The essential factor to this object is a moderate and increasing depth of easy pulmonary exchange.

With this object in view, Messrs. Down Bros. have made me an apparatus. It consists of (1) a face-piece with a vent which has four small apertures on the side. The vent is fitted with a screw cap by means of which the apertures are opened and closed. This is not a valve. When open, inspired as well as expired air readily pass through it while



1. Face-piece with perforated vent,
2. Screw Cap to close.

any excess in tension of gases in the bag pass through it to the atmosphere; (2) a one gallon bag which is attached to the face-piece by means of a short right-angled hollow metal tube.

The procedure in an infant is as follows:—

1. Put the face-piece on the patient's face with the vent fully open.

2. After ten seconds turn on nitrous oxide and oxygen.

3. The gas-bag begins to fill but any excess in tension of gas passes out through the apertures in the vent.

4. The infant's expirations pass very readily through the apertures in the vent while gas and oxygen under slight tension in the bag, is inhaled.

5. Every thirty seconds one aperture in the vent is closed until only one aperture remains open.

6. The proportion of nitrous oxide to oxygen is modified to suit the patient.

This simple apparatus has to a very large extent surmounted the tidal wave and expiratory difficulties met with in infants and young children. In an experience extending over a large number of cases, I have found the induction of anæsthesia with gas and oxygen much shorter and easier both to the patient and the anæsthetist while the maintenance has been free from the evil effects of excessive rebreathing, the toxic effects of excess of nitrous oxide and the danger inherent in excessive positive pressure of the gases in the bag.

The face-piece is made in two sizes, one for infants and one for children.

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2. "Hewitt's Anæsthetics," 5th Edit., p. 125.
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4. "Blomfield, Anæsthetics," p. 283.

INHALATION OR INJECTION NARCOSIS?

The Development of the Specialty of Anæsthesia in Germany.

By HELMUT SCHMIDT.

Privatdozent Chirurgische Universitätsklinik Hamburg—Eppendorf. (Direktor: Professor Dr. P. Sudeck).

IN Germany, there are practically *no* specialists in anæsthesia; at the universities there is *no* special course in this branch, the service not being organized; moreover, until recently we have had no gas anæsthesia.

Do not think that our work in anæsthesia is done in a careless or in a negligible manner or that we have done no research in this line.

Abroad, two methods have been specially developed: (1) superficial ether narcosis and ether anæsthesia by the drop method, sometime with warm ether, beginning with ethyl-chloride, intravenously or rectally; (2) local anæsthesia with its modifications, spinal, sacral and especially splanchnic, the latter having been discussed by Finsterer in 1925.

During the past two or three years studies in anæsthesia have been undertaken in Germany. The search for new methods and agents is very acute. Our new journals of anæsthesia represent a remarkable milestone in the development of this important branch of medical knowledge. Above all, we have still to suffer from obstacles of an economic nature, which retard rapid advances. My colleague, Dr. Killian, and I represent the modest beginning of a German society of anæsthetists! We, as surgeons, are convinced of the importance of this special branch. Every well-informed practitioner, in arranging for an operation upon himself, would probably decide first on the anæsthetist before all and thereafter would choose the surgeon.

The two methods, which, as before mentioned, go side

by side in Germany, bring up the question under discussion: Anæsthesia by inhalation or by hypnotics? Local anæsthesia and its special field of administration, although very extensively employed in our country, will not be touched upon in these remarks.

Every method of producing anæsthesia is characterized by the progressive changes in the variable concentration of narcotics in the blood. Rise, peak and ebbing off. Concentration and intensity of effect proceed along parallel lines, proportionally.

The inhalation narcotics, especially the gases, are characterized by a rapid concentration in the blood, the result of their rapid absorption through the extensive lung surface. Here the anæsthetist can readily maintain the most desirable concentration even at the maximum, adapting it constantly to the requirements of the individual patient, his general state and the general progress of the operation.

Opposed to these old and proved methods, we have injection anæsthesia, a method which attempts to produce unconsciousness during the entire operation by the intravenous or rectal injection of drugs, such as certain alcohols and barbituric-acid derivatives. Internists, surgeons and pharmacologists of the highest standing are at present at work in Germany developing and improving this method. These studies, which have for their object a riskless anæsthesia, will result in progress to the physician and decided benefit to the patient. *The knowledge of an approaching operation often reacts in a serious and sometimes even dangerous manner upon the mental condition of the patient.* The new method greatly diminishes this danger. Many pulmonary complications can be avoided. At the same time the surgeon as well as his assistants do not suffer from the effects of anæsthetic vapours.

The difficulty of these methods, however, lies in regulating the dosage and in directing the anæsthesia. Theoretic objections have been abundant and quite a number of surgeons have protested particularly against complete injection narcosis. The dosage is regulated according to the weight and constitution of the patient and is, so to speak, arranged prior to the beginning of the anæsthesia. This means, that after the

injection, the anæsthetist no longer has any material influence upon the conduct of the case. "Steering" (that is, the further regulation of the intensity of the anæsthesia), is impossible. The course of the wave of narcotic concentration, and therefore of the narcosis, is automatical. Ebbing of narcosis proceeds very slowly, since the elimination of the anæsthetic is not affected through the respiratory tract, but chiefly through the liver.

One preparation has apparently distinguished itself quite remarkably among the series of injection narcotics, especially because of its prompt absorption, rapid loss of toxicity and its wide margin of safety. I have in mind rectal anæsthesia with avertin, chemically known as tribrom-ethyl-alcohol, *i.e.* an alcohol with three bromine atoms. It is a powder, soluble in water, of a bitter taste, and was first synthesized by Duisberg from tribromaldelyd by means of a fermentation process. This drug is administered per rectum in a three per cent. solution. Completely satisfactory narcosis results in 50 per cent. of cases from doses of 0.1 gm. per kilo body weight and in 75 per cent. from doses of 0.15 gm. per kilo body weight (the maximum dosage).

Theoretic objections to the principles upon which avertin is based are few. Those who have had a large practical experience with it are in its favour. Among its advocates, two groups can be distinguished. Those who desire to produce a complete anæsthesia, and those who wish merely to use the injection as a primary narcosis. The latter produces thereby a more or less deep state of unconsciousness, which in some cases is sufficient for the operation. Thereafter, with only a very small amount of inhalation anæsthesia, the narcosis can be increased and regulated. If I am not mistaken, Gwathmey advocates his "synergistic anæsthesia" with the same underlying idea and with a similar method.

In spite of all adverse opinions, which in the beginning were intensified by accidents due to overdosage or failure in preparing the solution correctly, avertin has clinically demonstrated its value and has given practical results in about thirty thousand cases. Sauerbruch, the well-known German surgeon, has remarked that avertin represents the most remarkable progress in the science of anæsthesia in recent

years. We believe that avertin will continue to be employed and that with a proper selection of patients, in whom other methods of anæsthesia seem inadvisable, it constitutes at this time a better means of producing narcosis than any other agent. Avertin will, no boubt, have other uses besides those described. For instance, we have administered the drug rectally for four days to a morphine addict and were thus able to free the patient from her habit. Of course, we realize that the last word on this subject has not yet been spoken. Perhaps still better agents will be found in the future.

In contra-distinction to this advance in anæsthesia, there are those at present in larger numbers who are endeavouring to improve inhalation narcosis. This group advocates the use of various gases, considering them as superior because anæsthesia by them is easily regulated and the effects on the metabolism are much less marked. They prefer this method because the anæsthetist is at all times master of the procedure, which can readily be adapted to any desired stage.

Ether remains ether however administered, rectally or intravenously, warm or cold. Certain possible dangers can be avoided; however, the metabolic disturbance, for instance of the liver, remains the same regardless of how this agent is administered. In our acidosis tests after ether, we found an increase in lactic acid in the blood for several days, while this was absent after gas and avertin administration. Embden is of the opinion that the increase of lactic acid in the blood is due to the action of ether on the liver.

Therefore, we cannot be grateful enough to men like Drs. Luckhardt, of Chicago, and Wieland-Gaus for having enriched gas anæsthesia through the introduction of ethylene and acetylene. The clinic of Dr. Sudeck in Hamburg Eppendorf was one of the first to adopt gas anæsthesia with acetylene, the great advantages and beneficial qualities of which were quite enthusiastically proclaimed.

In collaboration with a German government laboratory in Berlin especially created for this purpose, we have studied particularly the problem of the risks of explosions. We found that the danger can be reduced, but not entirely eliminated. There are two kinds of dangers:

1. Open flames. This danger is negligible. Our gas

analyses showed that in a small room after six hours of continuous anæsthesias the percentage of acetylene remained below 0.1 per cent. At 30 centimeters distance from the gasmask—open method—the concentration was below 1 per cent. Risk of explosion commences at 3 per cent.

2. Danger due to spontaneous combustion of acetylene is very much greater even with correct grounding. The cause of some explosions could not be determined at all. The possibility of an oil-oxygen combustion leading secondarily to an acetylene explosion may give a clue in some cases. In combination with ether the ignition point of such a mixture is depressed from 300°C. to 175°C. Metal parts, such as pure copper and silver, must not be used on account of the formation of highly explosive oopper and silver acetylene compounds.

The possibility of explosions occurring during attempts to produce anæsthesia with acetylene caused it to fall into disfavour in Germany and nitrous oxide, the original gas method, which never had a large following in our country before, has now taken its place. After the war we had neither the apparatus for N_2O. anæsthesia nor the gas and were compelled to secure both from America. Our clinic has, since then, devoted all of its experimental research to nitrous oxide-oxygen anæsthesia and has developed it from many important viewpoints. Our favourite method, at this time, is to give an exact and continuous dosage of oxygen together with a filtration of carbon dioxide, as described by Dr. Waters, and as introduced into Germany five years ago. In this method we effect a considerable economy by the use of 1-2 liters of gas per minute, carrying it on with the greatest safety. Thus far, in 3,000 cases we have safely produced a very prolonged anæsthesia. In addition, we are under the impression that the N_2O anæsthesia is induced more quietly when carbon dioxide filtration is employed and we give the latter only in the beginning and at the end of the anæsthesia.

N_2O anæsthesia has been used by us in from 30 per cent. to 40 per cent. of our patients which have been carefully selected. We try to avoid cyanosis. With this in mind we begin with 10 per cent. oxygen and after one to two minutes gradually increase to 20 per cent. oxygen. Rather than take

the chance of cyanosis, ether is given at this stage. Thus, after waiting for 10 minutes, we can produce anæsthesia in about 40 per cent. of our patients with an unmixed N_2O-O medium. 50 per cent. of our cases require a very small amount of ether in addition.

We have had no experiences with ethylene; but have given over 2,000 acetylene anæsthesias. This form of anæsthesia is deeper than that with N_2O and can be employed with large quantities of oxygen (40 to 60 per cent).

One can readily conclude that the introduction of a method like acetylene in the employment of which we need but add ether in 20 per cent. of the cases, would mean considerable progress, if the danger of explosion would not demand the greatest precautions. The danger is due to the molecular structure of acetylene and is greater than in the case of ethylene, which has come into use especially in the United States.

Compared with N_2O, other unfavourable features of acetylene are its odour, the need for large gas cylinders and the complicated apparatus, which effects the purification of the C_2H_2 by separating the aceton. The occasional very severe griping and the forced exhalations caused by acetylene are disturbing elements. These are especially unfavourable factors in regard to acetylene.

Furthermore, the expiratory abdominal tension caused by acetylene cannot always be avoided. The addition of ether produces only a minor improvement as regards these complications, in contra-distinction to N_2O narcosis, in which a few drops of ether are sufficient at times to deepen the anæsthesia and to obviate the abdominal tension. We believe that this can be explained by the postulate of Burgi: "A mixture of two narcotics, each of which has a different field of pharmalogical attack, results in an effect greater than a mere addition." It constitutes a multiplication of the added results. Nitrous oxide and ether belong to different chemical groups, while acetylene and ether belong to the same hydrocarbon series. Burgi's conclusion applies to the former of these.

The disadvantages of the C_2H_2 could easily be disregarded; we could achieve greater progress with the same degree of safety, because with a deeper narcosis the lack of oxygen could surely be avoided. The only real disadvantage is the great

danger of explosion of acetylene in combination with oxygen even without open lights being in evidence and with proper grounding. In about sixty thousand cases of anæsthesia with acetylene, five explosions have occurred, causing one death and numerous injuries. To-day the apparatus has been so improved that it is said to be explosion-proof. Perhaps the method will once again meet with favour. At present the interest in N_2O narcosis in Germany is far more intensive.

Tests are now being made in Germany with various narcotic gases and combinations of these (propylene-N_2O). We believe that this entire question, like injection anæsthesia, is perhaps more a chemical than a pharmacological problem.

We, in Germany, hope to make progress when we are in a position to educate practitioners in the expert methods of anæsthesia. The collection of experiences on a large scale can then be used to its full extent. The University of Hamburg is the first in Germany to attempt to solve this problem and, as a lecturer there, it will be my special desire to develop the educational questions and aims of this most important branch of science. It is our intention to establish in Hamburg a school of anæsthesia and we intend to form a German society of anæsthetists at the next congress in Hamburg in September 1928. In Germany under the present conditions such a development takes considerable time. I am convinced, however, that within a few years, we will be in a position to discuss intelligently the subject of narcosis in all of its branches, especially as to its technique, organization, and educational features.

In conclusion: Inhalation or injection? Gas or ether? Nitrous oxide or acetylene? General or local anæsthesia? Such extremes are not tenable, since there is no universal method and no universal narcotic. It is therefore necessary to adapt oneself to the needs of the individual as to his conditional and constitutional peculiarities, and to vary the procedure in each case, if necessary, be it by *individual selection* and correct determination of the *indications of each single* anæsthetic; or by attempts to diminish the risk by a *combination* of various agents. The aim must be to obtain the best results as well as the greatest safety to all concerned. The method of anæsthesia should, of course, be as simple as conditions will allow.

However, whatever point of view each of us represents, we must endeavour to concentrate and interchange our experiences in this special branch of medical science, if we want to be assured of real progress.

NOTES.

DR. HELMUT SCHMIDT, Associate Professor of Surgery of the Eppendorf Hospital, Hamburg, visited London and Manchester in his investigation of the teaching and practice of Anæsthesia in England. He spent two months in America in the same quest, and reported his findings to the Annual Congress of German Physicians and Surgeons. This association has recently considered the advisability of recognizing Anæsthesia as a distinct speciality, and it is quite possible that Dr. Schmidt's visit abroad will result in placing this work in the hands of experts in the near future. A Section of Anæsthesia will become a regular feature of these Congresses.

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DR. F. P. DE CAUX of London, attended the recent Congress of Surgeons, Hamburg, and gave a demonstration of his gas-oxygen machine.

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DR. F. H. MCMECHAN, Secretary-General, Associated Anæsthetists of the U. S. and Canada, spent several days in London recently and was entertained at dinner by a number of Anæsthetists. He also visited Glasgow and Edinburgh, and renewed acquaintance with old friends. He was accompanied by Mrs. McMechan.

THE DEVELOPMENT OF ANÆSTHESIA IN WESTERN CANADA.

By W. Webster, M.D., C.M.

Anæsthetist, Winnipeg General Hospital.

OCCASIONALLY one reads an account of the progress of anæsthesia, or of the advance made in teaching this subject in various places, therefore it occurred to me that its development in Western Canada might not be without interest. I accordingly collected the material available but must apologise for any information unwittingly omitted, for it may be that "some mute inglorious Milton" unknown to myself, has been, in his own locality, doing considerable work in this speciality.

Speaking of our own Western City. It was evidently early recognised by those engaged in surgical work that skilful anæsthesia was a most important adjunct to its success and to their own piece of mind during the actual operation, for as early as 1899 we find recorded in the minutes of the Winnipeg General Hospital the appointment of Dr. Hutton as Honorary Anæsthetist. The position was held by him until 1900 when he left Winnipeg to reside in Vancouver. In 1901 Dr. Chestnut received the appointment which he held until January 1902 resigning the post for the practice of internal medicine. On his resignation, the writer was appointed to this position which has continued with him to the present time.

In one's student days our only instruction consisted of a lecture on chloroform and ether from the professor of Materia Medica, in which it was insisted that chloroform was extremely dangerous in more than four per cent. concentration, though in 1897, when in England, I saw this anæsthetic given in one large hospital by Simpson's original method, *viz.* on a piece of lint folded into three or four layers. The patient's face was well covered with vaseline to prevent the action of

the chloroform on the skin. Then one or two drams of the chloroform were poured on the lint and the latter applied closely to the victim's face, a method by which it has since been shown that as high a vapour content as 13 per cent. may be inhaled. The patient invariably struggled but willing hands of medical students were ready to control these natural efforts against the powerful fumes, and he speedily succumbed; the induction not lasting more than two or three minutes. The above does not, however, describe the usual condition of affairs. At that time the British Isles were probably more advanced in the speciality of anæsthesia than any other country. Hewitt, Buxton, and many others were devoting their whole time to this speciality, while a great deal of laboratory research was carried on with the object of discovering the cause of anæsthetic fatalities, means of preventing the same and improvement in apparatus for administration. The Society of Anæsthetists had been formed in 1893 with F. Woodhouse Braine, F.R.C.S. as its first president; while at least a goodly number of medical schools gave instruction in anæsthesia to their students.

During the last two decades the United States has given us most in the way of nitrous oxide and ethylene anæsthesia. In that country apparatus for the administration of these gases has reached a higher degree of efficiency than elsewhere, for which we have to thank such men as McKesson, Heidbrink, Forreger, etc., the mechanical perfection of whose machines has placed nitrous oxide and ethylene on an altogether different plane of usefulness to that formerly attained.

From this digression into the status of the speciality elsewhere let us return to the "Woolley West." Except for the two lectures above noted, the only knowledge the student could gain was by watching the anæsthetist—usually a house surgeon—in the operating room, where either chloroform given on an Esmarch mask, or ether by means of a Clover or Allis inhaler was used. About 1893 Dr. Hutton introduced a Junker's chloroform inhaler with which he gave many anæsthetics although it was later, as seen above, that he was officially appointed Honorary Anæsthetist. There was a certain fascination in watching the air bubble through the chloroform and the little feather at the top of the face mask

rise and fall with the patient's respiration. We were inclined to regard it in those days as rather a scientific method of administration and I later found it convenient for use in tonsil and other mouth and nose operations; but about 1903 made up an apparatus for vapourizing ether in the same manner, except that the ether bottle was placed in a tank of warm water to hasten evaporation and with the idea of warming the vapour.

In lengthy operations the Junker bottle used to get quite cold owing to the evaporation of the chloroform and as the usual method of holding it was to suspend it by the attached hook from a button-hole in one's vest, or if wearing a gown, from a safety pin through the same, the suspended bottle touching one's chest after a time took on the sensation of a lump of ice against the part. In fact some anæsthetists actually developed a neuritis from this cause, and so were constrained to hang the bottle on some other support if available, when in the operating room. In obstetric cases the rail at the head of the bed formed a convenient place.

Here, until 1904 there was no organized method of teaching students but in that year the Dean of the Medical Faculty requested me to give a few lectures on anæsthesia. I accordingly gave a course of four and the following year, 1905, was appointed to the College of Faculty as lecturer in anæsthesia. In that year and a few succeeding, the course adopted was that which prevailed in Edinburgh at the time, viz. that each fourth year student should attend four didactic lectures and twenty cases of anæsthesia in the operating room. Earlier in his medical studies he also had the opportunity of anæsthetising animals during the course in practical physiology.

A gradual increase in the work done by the student has been demanded so that now he receives eight didactic lectures in anæsthesia and spends two and a half weeks in the operating room where he is taught the practical side of the subject for five to six hours each day and administers anæsthetics under supervision. In his fifth year he spends two months as assistant in anæsthesia. At the end of the fourth year he is subjected to an examination in which 40 per cent. of the marks are allotted to the manner in which he has conducted himself

and the aptitude shown by him in his practical work during the time spent in the operating room.

For several years prior to 1912—I have been unable to ascertain the exact date—Dr. J. W. Thomson occupied the position of anæsthetist at the Vancouver General Hospital. In that year Dr. C. H. Bastin was appointed and held the position until about 1920 when he was compelled to retire from full time work at this speciality on account of health considerations. Dr. Freeze has directed the department since 1920.

For some years other Western Cities, Edmonton, Calgary, Regina, etc., have seen the necessity for specialists in this Art and it is confidently anticipated that before long all the Western Cities and Towns of sufficient size will contain at least one Graduate in Medicine who makes a speciality of Anæsthesia.

INTRATRACHEAL NITROUS OXIDE OXYGEN ANÆSTHESIA.

By Ralph Hargrave, Toronto, Canada.

SYNOPSIS.

THIS method which we have worked out has been on the principle of using a thin walled flexible silk elastic, silver wire woven catheter, which snugly fits the larynx and allows the patient to breathe the proper mixture of gasses, inspiring and expiring through the catheter under low pressure and using the ordinary respiratory valves of the gas machine, a mercury manometer not being necessary.

Method for Intratracheal Nitrous Oxide Oxygen Anæsthesia.

One hour before operation the patient is given a hypodermic injection of a hyoscine morphine cactin tablet No. 1. Fifteen minutes before, the patient is allowed to dissolve in the mouth an anæsthesin calcadin troche. This latter, we believe, helps to render less sensitive the base of the tongue and epiglottis. At the beginning of the anæsthetic, the patient is put in a prone position, and the nasal inhaler of the gas oxygen apparatus is placed over the nose. A closed mouth gag is placed in the mouth and a warm wet towel wrapped around it. The patient is then told to breathe through the nose, and the proper mixture of nitrous oxide and oxygen is given for induction purposes. Ether is then added gradually until the jaw is relaxed sufficiently to allow the mouth gag to open it. The laryngoscope is then introduced and, when the epiglottis is raised with the lip of the instrument, the vocal chords are exposed. The catheter is next passed through the laryngoscope and the tapered end inserted into the opening of the larynx. At this time, the larynx will usually be found in spasm, with the chords together, and if

one waits a few seconds the patient will take a deep inspiration and, with gentle pressure, the catheter may be introduced about one inch beyond the vocal chords into the trachea. The catheter is then connected to a McKesson adapter which is, in turn, connected to the ordinary breathing tube of the gas apparatus.

The catheters used are Nos. 32, 34 and 36 French Guage, silk elastic, silver wire woven, with an oblique opening at the end. These catheters have been specially made to our specification by Down Brothers, London, England. We find that No. 32 fits the larynx of older children, No. 34 that of young women of average size, and No. 36 of men.

Following the introduction of this catheter, the ether is discontinued and the patient breathes quietly a straight mixture of nitrous oxide and oxygen under a pressure which is the same, or perhaps less, than that used with the ordinary face mask. The exhaling valve on the adaptor operates the same as when giving nitrous oxide with the face mask. We have found that one may use ten or twelve per cent. oxygen by this method and still keep the patient anæsthetized. When the operation is completed the patient is allowed to breathe pure oxygen, and the catheter is removed.

In tonsillectomies this method of anæsthesia allows the surgeon sufficient time to remove the tonsils and stop any hæmorrhage. Meanwhile, the patient is under the control of the anæsthetist at all times. The large size of the catheter does not seem to hinder the surgeon.

If the catheter fits the trachea of the patient snugly and allows no air to be inspired around it, one will obtain perfect anæsthesia with about 10 per cent. oxygen.

That the advantages of this method are very marked is shown in a series of some 40 consecutive cases, in which the patients have recovered from the anæsthetic almost at once and there has been no nausea or vomiting of any kind whatsoever and, needless to say, no pulmonary complications have occurred at all.

We believe that this method of anæsthesia will allow nitrous oxide and oxygen to be used for nose, throat and mouth surgery, to the same extent that it is used in general surgery. One should keep in mind that there will always

be a certain number of cases in which full relaxation cannot be secured with nitrous oxide and oxygen alone, and that the addition of a small amount of ether may be necessary at times to control the patient, but this will not necessarily affect the result of the gas anæsthesia.

In summarizing this paper the following points should be noted.

Disadvantages.

1. The technical difficulty of introducing the intra-tracheal catheter.

Advantages.

1. Rapid recovery from the anæsthetic.
2. No nausea or vomiting whatever.
3. Low pressure of gases being used means lower cost.
4. No pulmonary complications.
5. Close fitting catheter prevents the escape of foreign bodies into the trachea.

THE INFLUENCE OF ANÆSTHESIA ON THE BLOOD-CONTENT OF THE LUNGS DURING TONSILLECTOMIES.

By Drs. Louis and Ray K. Daily.

THAT anæsthesia is the most important factor in controlling the blood content of the tracheo-bronchial tree during tonsillectomy was the observation made in a series of bronchoscopic and oesophagoscopic examinations of post-tonsillectomy cases; the object of these investigations was to determine the condition of the tracheo-bronchial tree, immediately following tonsillectomy, in the hope that the examination would throw some light on the etiology of post-tonsillectomy lung abscess. While a great many observers believe that post-tonsillectomy lung abscess is caused by an embolism from the wound, the rôle played by infected material aspirated during the operation has not been definitely determined, nor eliminated.

One hundred cases were bronchoscoped and oesophagoscoped immediately following the tonsillectomy; none of the patients developed any untoward symptoms following the examination, and we feel that the procedure involved no risk to the patient. The majority of patients examined were children between the ages of six and twelve; the youngest patient was three years old, and the oldest thirty-five. All were hospital cases and had the routine preliminary physical and laboratory examinations, so that a child whose physical condition indicated a greater than ordinary surgical risk, did not reach the operating table. The time consumed by the operations varied from a few minutes to forty-five minutes, depending upon the amount and time required to check post-operative bleeding. The tonsils were removed by the dissection and snare operation or the Beck-Sluder instrument. The general anæsthesia was administered by an expert anæsthetist, and consisted of nitrous oxide and oxygen induction, followed by ether until sufficient relaxation was

induced to permit the introduction of the mouth gag; from then on a warm ether spray was continued throughout the operation. Suction was employed as constantly as possible. After the operation was completed and the pharynx was dry, the trachea and bronchi were examined with the Coller Light Vienna model bronchoscope. The same tube was passed into the oesophagus, and often the stomach contents ran out through the tube; if not, the inner tube was passed to the cardiac orifice of the stomach. The introduction of blood with the tube was eliminated by beginning the bronchoscopy after the field was dry, lowering the patient's head, and applying suction to the hypopharynx and over the vocal cords, through the bronchoscope as it was advancing.

Much to our surprise the first series of about thirty-nine cases revealed the constant presence of blood in the tracheo-bronchial tree; the first case in which the tracheo-bronchial tree was free of blood, was a twelve year old girl whom, for some reason, the anæsthetist was unable to anæsthetize deeply; she had a profuse hæmorrhage, requiring several sutures, and because she was gagging and vomiting the operation lasted longer than usual, and her mouth was full of blood in spite of suction. We expected to find the trachea full of blood, but a bronchoscopy showed the lungs free of blood; an oesophagoscopy showed a large quantity of blood in the stomach. It was apparent that the lightness of anæsthesia—which was the only point of difference between this and the preceding operations—was a factor in the absence of blood from the lungs. The following investigations were conducted with the object of determining the influence of anæsthesia on the blood content. The series of cases consisted of :—

Deep anæsthesia, 30 cases, bronchoscopy only—blood was found in the tracheo-bronchial tree in all cases.

Deep anæsthesia, 37 cases; bronchoscopy and oesophagoscopy; blood found in the tracheo-bronchial tree, and none in the stomach in 33 cases. Blood found in both in two cases; blood absent from lungs and stomach in two cases (operations were bloodless).

Attempted light anæsthesia in 33 cases; oesophagoscopy and bronchoscopy. In 21 cases the entire operation

was performed under light anæsthesia. Blood was found in the stomach and not in the lungs in 17 cases. Blood in both in two cases. Blood in the lungs and not in the stomach in two cases.

In the other twelve cases the anæsthesia was deep; in three cases there was no blood in the lungs or stomach; in these cases the operation was bloodless. In nine cases there was blood in the lungs and none in the stomach.

In 79 cases bronchoscopy, the tonsillectomy was performed under moderately deep anæsthesia; the swallowing reflex was abolished, and there was no gagging, straining or resistance to the tongue depressor. In 74 of these 79 cases, or 94.9 per cent., the tracheo-bronchial tree was found to contain blood. The amount of blood varied from a quantity which filled the trachea and bronchi, to a much smaller amount, insufficient to obstruct the lumen of the trachea. In some cases, there seemed at first no blood present, except, perhaps for a slight staining of the tracheal rings, when following a coughing spell, blood would appear in the tube, coming up from the deeper bronchi. The five cases of this group, in which the lungs were free of blood, were all very young children, and the operations were conspicuous for the absence of post-operative bleeding.

In 21 cases bronchoscoped the operation was performed under light anæsthesia, with the pharyngeal reflexes intact. This is a state of anæsthesia rather difficult to maintain. As may be seen from a schematic chart of the various stages of anæsthesia, the third stage is the one of surgical anæsthesia, In the second stage there is vomiting, retching and coughing. In the upper border of the third stage, when the eyeballs are oscillating and the larynx moving up and down, the swallowing reflex is still present. This state is difficult to maintain, because if the anæsthesia is just a little lighter, the patient is vomiting, and if it is a little deeper, the swallowing reflex is abolished. In this stage, there is still some straining, and the operation is considerably more difficult, particularly where there is a considerable amount of post-operative bleeding, and consequent suturing. The number of cases in which the swallowing reflex was present during the entire operation was 21; the attempt was made to do so on a greater number of

patients, but in some of them it was necessary to deepen the anæsthesia, and in some the anæsthesia was unintentionally deepened by the anæsthetist. Of the 24 patients, four, or 19 per cent., had blood in the lungs; a very much smaller percentage as compared with the 94.9 per cent. of the patients operated under deep anæsthesia.

The last seventy cases were bronchoscoped and oesophogoscoped. Of these, 49 were under deep anæsthesia, and 21 under light. Of the 49 cases under deep anæsthesia 4, or 8.16 per cent. had blood in the stomach contents. Of the 21 under light anæsthesia 19, or 90 per cent., had blood in their stomach contents. Usually the oesophagus shows no traces of blood, even when there is blood in the stomach. Only in a few instances did we encounter blood in the oesophagus itself.

The outstanding phenomenon in our investigations was the almost constant combination of the presence of blood in the lungs, and its absence in the stomach, or *vice versa*, its presence in the stomach and absence in the lungs. We found an explanation for this, at first puzzling phenomenon, in a study of the swallowing reflex. The act of swallowing is a complicated reflex, which may be initiated voluntarily, but is completed independently of the will. When food or drink comes in contact with the pharynx it stimulates the afferent sensory nerve endings and causes a reflex contraction of the mylo-hyoid muscle and a peristaltic oesophageal wave. Simultaneously co-ordinated movements of other muscles shut off the nasal and laryngeal openings; the soft palate shuts off the nasal cavity, and the adductors of the larynx and epiglotis close the larynx, causing a temporary inhibition of respiration. The larynx is an open space with air going in and out; the oesophagus is closed at the crico-pharyngeal constriction, which, as pointed out by Jackson, is like an incomplete sphincter at this point. The larynx is protected from the aspiration of food by the swallowing reflex which is stimulated by food coming in contact with the pharyngeal wall. Even moderately deep anæsthesia abolishes the swallowing reflex.

Our findings in this series of cases leads us to believe that secretions and blood from the hypo-pharynx are swallowed as long as the pharyngeal reflex is intact; when the depth of anæsthesia abolishes the pharyngeal reflex blood and secre-

tions enter the larynx and the lungs. This conclusion is borne out by the fact that whenever the operation was completed with the swallowing reflex intact the lungs were found to be free of blood, and the stomach contained blood. Where there was slight anæsthesia for a part of the operation, and the anæsthesia was deepened before the operation was finished, blood was found in the lungs and stomach; where the anæsthesia was deep throughout the operation there was always blood in the lungs and none in the stomach.

The factors investigated with ragard to their influence on the presence of blood in the lungs were:—

1. The amount of hæmorrhage; the more bleeding there is during the operation, the more blood is contained in the hypo-pharynx, and the more is aspirated. Where the operation is bloodless, there was no blood in the lungs or stomach.
2. Position of the head; even with the head of the patient on a table lowered 45 degrees, there was always some blood in the stomach, in deeply anæsthetized cases; the amount was decidedly less, as compared with the amount in cases operated on in a horizontal position.
3. Elimination of the ether spray had no effect whatever.
4. The depth of anæsthesia was the deciding factor in the presence or absence of blood in the lungs.

In a review of the literature on the subject, we found that Myerson of Brooklyn did a series of one hundred post-tonsillectomy bronchoscopies and published his findings in the *Laryngoscope*, in 1922. He did not perform oesophagoscopies in these cases and therefore failed to observe the constant relation of blood in the lungs and its absence from the stomach, and *vice versa*. He apparently used deep anæsthesia in the cases reported, because he states in the article referred to, that the patients were anæsthetized prior to the operation, and no anæsthetic administered during its course. In 1925, in an article on "Observations upon the Cough Reflex," he states that out of 22 cases in which the patients coughed during the operation, 18 had no blood in the tracheo-bronchial tree. These patients were very likely operated upon under light anæsthesia and the swallowing

reflex was present with the cough. He concludes that "moderately deep anæsthesia is the anæsthesia of choice." Our experiments have convinced us that quite to the contrary, the very lightest anæsthesia which will permit of an operation, is the anæsthesia of choice as far as the freedom of the lungs from blood is concerned, because the only possible way to insure absence of blood and secretions from the lungs, is to operate with the pharyngeal reflexes intact. This makes the operation, technically more difficult, because the patient may gag or strain, and the introduction of sutures, if required, is very difficult, unless the pharyngeal reflexes are abolished. However, in our opinion, the additional safety to be gained justifies the difficulty of the operation.

NOTES.

Officers of the Canadian Society of Anæsthetists are: President, W. B. Howell, Montreal; Vice-President, G. M. Geldert, Ottawa; Secretary-Treasurer, W. J. Defries, Toronto.

The Eastern (U. S.) and Canadian Anæsthetists held a combined meeting at Boston, Mass., Oct. 8-12th. Among the papers were the following:—

"Reflections of an Anæsthetist," Wm. B. Howell, Montreal.

"Blood Gases and Anæsthesia," Wesley Bourne and Prof. Dryer, Montreal.

"Methylprophlcarbinol Urethane," John Donald, Glasgow.

"Intratracheal Ethylene-Oxygen Anæsthesia," Harold R. Griffith, Montreal.

"Intratracheal Nitrous Oxid-Oxygen Anæsthesia," Ralph Hargrave, Toronto.

"Effect of the Prolonged Inhalation of Small Percentages of Ether Vapour," W. Easson Brown, Toronto.

"Further Studies in Anæsthesia and Cardiology," G. H. Brow, and C. N. H. Long, Montreal.

The Associated Anæsthetists of the U. S. and Canada have presented a beautiful bronze bust of Morton to the Massachusetts General Hospital on the Annual Ether Day Celebration, Oct. 12th. Upon the same day Morton's grave in the Cambridge (Mass.) cemetery was visited and wreaths were placed upon the monument erected by the citizens of Boston.

OBITUARY.

WILLIAM BARRAS, M.B., Ch.B.
GLASGOW.

THE news of the sudden death of Dr. William Barras on 29th July at the early age of 35 came as a great shock to his many friends. He was motoring alone when his car collided with a telegraph pole and he was killed instantaneously.

On the outbreak of War, Dr. Barras was studying medicine at the University of Glasgow. He immediately joined the Army and served in the Royal Scots as a combatant. He rose to the rank of Captain when he was so severely wounded in the lower jaw that he was invalided out of the Army in 1916. On recovering sufficiently from his wounds he resumed his medical studies and graduated M.B., Ch.B. in the University of Glasgow in 1918. After holding the appointment of House Physician in the Western Infirmary, Glasgow, he devoted himself entirely to the practice of Anæsthesia. He was for a time Anæsthetist, Ministry of Pensions Hospital, Bellahouston, Glasgow, and for the past eight years held the appointments of Anæsthetist, Western Infirmary, Glasgow, and Anæsthetist and Lecturer on Anæthetics, Dental Hospital, Glasgow.

At the time of his death he was President of the Scottish Society of Anæsthetists, and he delivered his Presidential Address on the subject of Stovaine at the Annual Meeting of the Society in Edinburgh in May of this year. This address was published in the July number of the *British Journal of Anæsthesia*.

Dr. Barras was very popular with his fellow workers and had a large circle of friends. Everyone admired the cheerful and patient way he bore the suffering caused by his war wound. He was an enthusiastic and skilful anæsthetist, much sought after by surgeons on account of the freedom from anxiety they enjoyed while Dr. Barras was in charge of the anæsthetic.

He is survived by his widow and two young children for whom everyone feels the greatest sympathy.

THE SIDNEY RAWSON WILSON PRIZE.

As announced in the January number of the *British Journal of Anæsthesia* for the best INHALATION ANÆSTHESIA RESEARCH EFFORT, worthy of a premium, carried out by a citizen of the British Empire between that date and December first, 1928, a prize of Fifty Pounds is offered.

Every competitor is expected to conform to the following regulations :—

(1) To forward to the Secretary of the *British Journal of Anæsthesia* on or before the first day of December, 1928, a typewritten report of his or her work, in triplicate, with a *nom de plume* thereon, and also accompanying same a sealed envelope having the same *nom de plume* inscribed on the outside and his or her name and address within.

(2) All competitors assign to the *British Journal of Anæsthesia* all rights of publication.

(3) The *British Journal of Anæsthesia* reserves the right to decide if any effort received is of a sufficiently high grade to warrant the award.

NOTES.

The following is a list of officers of the Section of Anæsthetics, Royal Society of Medicine, for the year 1928-29 : President, Ashley S. Daly ; Vice-Presidents, F. E. Shipway, Z. Mennell, and Cecil Hughes ; Hon. Secretaries, H. A. Richards and John F. Ryan.